REMARKS

The subject invention relates to the use of grating targets to optically monitor overlay registration during the fabrication of layers on a semiconductor sample. In accordance with claim 1, the overlay target includes two test patterns. Each test pattern has a grating pair with the same line pitch. Each test pattern has an offset bias associated therewith, the offset bias being the difference in registration between the upper and lower grating layers. In one preferred embodiment, the preferred offset bias is equal to the line pitch divided by eight.

As defined in claim 1, there is a specific relationship between the offset bias of the first test pattern and the offset bias of the second test pattern. This offset difference is equal to the line pitch divided by four. This offset **difference** between the two targets should not be confused with the actual offset bias of the layers of either of the two targets. Thus, (and although not preferred) claim 1 could be satisfied if the offset bias of the first target was designed to be one-quarter pitch and the offset bias of the second target was designed to be zero. In other words (and in the context of the cited prior art to be discussed below) the offset bias of the first target could "D" and the offset bias of the second could be zero (not –D as in the prior art) as long as "D" in this case was one-quarter pitch.

The benefit to this approach is to avoid measurement dead spots for all values of overlay misalignment which can occur during fabrication of the layers. More specifically and as described in the subject specification, even if the actual misalignment of the layers results in one of the two targets falling into a measurement dead zone, the remaining target would in fact have a combined offset (intended offset bias plus the offset resulting from the misalignment created during the fabrication process) that would produce maximum sensitivity. (See specification, page 11, lines 10 to 17). As a result, if both targets are measured, at least one of the targets will always provide useful information. As noted in the abstract, "the combined optical response of the test patterns is sensitive to overlay for all values of overlay."

In the Office Action, the Examiner entered some objections to the claims. Applicant has amended the claims to address these objections.

In the Office Action, the Examiner rejected the pending claims based on the patent to Yang (6,892,793). As the Examiner correctly notes, Yang relates to an approach which uses grating targets to optically monitor overlay registration during the fabrication of layers on a semiconductor sample. Yang discloses that it is preferable to use two pairs of gratings. One

grating pair should be configured so that if the layers are in perfect registration, the position of the top grating will be offset by an amount "D" with respect to the bottom grating. The second grating pair should be configured so that if the layers are in perfect registration, the position of top grating will be offset by an amount "-D" with respect to the bottom grating. Yang believes that this symmetry is important to facilitate measurement.

Yang also includes an analysis regarding the selection of the ideal offset D in order to maximize measurement sensitivity. As noted by the Examiner, Yang suggests good sensitivity can be achieved if D falls between 5% and 40% of pitch width (corresponding to 1/20 to 1/2.5 of pitch width). Yang suggest that the best value of D should be at 25% of pitch width (1/4 of pitch width) (Yang, column 10, line 39+).

The Examiner then notes that applicant's preferred offset bias for each grating pair (1/8 pitch width) lies within Yang's range of 1/20 to 1/2.5. Further, if one selects that particular pitch width (1/8) from Yang's range and follows Yang's formula for two symmetric gratings, one with an offset bias of +1/8 pitch and one with an offset bias of -1/8 pitch, you arrive at applicant's claimed difference in offset bias between the grating pairs of one-quarter pitch.

Applicant agrees with the Examiner that one can find applicant's claimed configuration within the broad ranges of parameters suggested as acceptable by Yang. However, it is well settled that a claim to a particular set of parameters falling within a large range disclosed in a prior art document can nonetheless be patentable upon a showing of a special result not obvious from the prior art disclosure (see MPEP 2144.05). Applicant can demonstrate that this is the situation here.

First, Yang's teaching of optimum grating configurations is focused on maximizing the sensitivity of **a single grating pair**. Yang's Figure 5 (and the passage at column 10, lines 40 to 45) illustrates signal sensitivity as a function of the shift between the upper and lower grating in the one pair. As can be seen, the center of the peak of sensitivity is at one-quarter pitch (±25% of the pitch). Therefore, Yang specifically teaches that the preferred offset D should be set to a quarter pitch. Since Yang also teaches that the grating pairs should have equal, but opposite offset biases, the offset bias **difference** in Yang's preferred embodiment is one-half pitch. (It should be noted that Yang's preferred embodiment is similar to what is described as undesirable in applicant's background section.)

Yang does not consider the problem addressed by applicant concerning measurement dead zones. As described in applicant's specification, the preferred recipe suggested by Yang can result in both of the grating pairs being in a measurement dead zone for certain values of overlay error. In contrast, using applicant's approach, there is no value of overlay error where both of the grating pairs will be in a dead zone. Yang does not teach the special benefit to be achieved by having the difference between the offset biases of the grating pairs be one-quarter pitch. In fact, by teaching that offset biases of the two pair differ by one-half /2 pitch, Yang actually teaches away from applicant's preferred embodiment. Since applicant can demonstrate unexpected results from picking a particular combination of parameters within the broad range disclosed by Yang and can also demonstrate that Yang teaches away from applicant's claimed combination, applicant has rebutted the presumption of obviousness based on Yang.

In making his evaluation, the Examiner should also note that example he selected from the range of values disclosed by Yang is the only example that would fortuitously meet the limitation of applicant's claim 1. Stated differently, if one skilled in the art selected any other offset biases suggested by Yang, i.e. between 5% and 40% of pitch width (corresponding to 1/20 to 1/2.5 of pitch) the offset bias difference between the two sets of gratings would not equal one-quarter pitch but would range from 1/10 pitch to 1/1.25 pitch. The point here is that Yang clearly did not appreciate the special benefits of selecting the difference in offset bias to be one-quarter pitch since all of his examples (save the one selected by the Examiner) lead to a different result.

In view of the above, it is respectfully submitted that claim 1, which specifies a pair of test patterns "where the difference between the offset bias of the first test pattern and the offset bias of the second test pattern is substantially equal to the line pitch divided by four whereby the combined optical response to the measurement of the first and second test patterns is sensitive to all values of overlay alignment" is not taught or suggested by the disclosure in Yang of a broad range of different offset bias configurations and where Yang teaches a preferred arrangement (one-half pitch difference) which does not address the problem solved by the applicant.

Accordingly, it is submitted that independent claim 1 defines patentable subject matter and allowance thereof is respectfully requested.

Respectfully submitted,

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